

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1 (currently amended). A semiconductor apparatus comprising:

an under layer formed above a substrate;

a first insulating layer formed on said under layer; and

a first conductive portion formed in a first concave portion which passes through said first insulating layer to said under layer;

wherein said first conductive portion includes:

a first barrier metal layer formed on a side wall and a bottom surface of said first concave portion; and

a first metal portion formed on said first barrier metal layer such that the rest of said first concave portion is filled with said first metal portion; and

said first metal portion includes a first alloy comprising copper and ~~aluminium~~ aluminum;

wherein a containing percentage of aluminum in said first alloy is 0.1 to 10 atm%.

2 (cancelled).

3 (currently amended). The semiconductor apparatus according to Claim ~~[[2]]~~ 1, further comprising:

a second insulating layer formed on said first insulating layer and said first conductive portion; and

a second conductive portion formed in a second concave portion which passes through said second insulating layer to said first conductive portion;

wherein said second conductive portion includes:

a second barrier metal layer formed on a side wall and a bottom surface of said second concave portion; and

a second metal portion formed on said second barrier metal layer such that the rest of said second concave portion is filled with said second metal portion;

said second metal portion includes a second alloy comprising copper and ~~aluminium~~ aluminum;

said first conductive portion is one of an interconnection and a via,

said second conductive portion is one of an interconnection and a via, and

a containing percentage of ~~aluminium~~ aluminum in said second alloy is 0.1 to 10 atm%.

4 (original). The semiconductor apparatus according to Claim 3 wherein a ratio of an area of larger one of said first conductive portion and said second conductive portion to an area of the other is equal to or greater than 20.

5 (currently amended). The semiconductor apparatus according to Claim ~~[[2]]~~ 1 wherein a resistance of said first conductive portion is lower than that of said first conductive portion when said first metal portion consists of ~~aluminium~~ aluminum.

6 (original). The semiconductor apparatus according to Claim 5 wherein an aspect ratio of said first concave portion is equal to or greater than 2.

7 (original). The semiconductor apparatus according to Claim 6 wherein a width of said first conductive portion is equal to or less than 0.18 μm ,

a depth of said first conductive portion is equal to or greater than 0.3 μm ,

a thickness of said first barrier metal layer is equal to or greater than 0.01 μm , such that said first metal portion is formed in said first concave portion.

8 (withdrawn). A manufacturing method of a semiconductor apparatus comprising the steps of:

(a) burying a first conductive portion comprising copper in a first insulating layer which is formed on an under layer formed above a substrate;

(b) forming an additional metal film comprising aluminium on said first conductive portion;

(c) carrying out a heat-treatment to make an alloy of copper in said first conductive portion and aluminium in said additional metal film; and

(d) removing materials on said first insulating layer and said first conductive portion such that said first conductive portion is one of an interconnection and an via.

9 (withdrawn). The manufacturing method of the semiconductor apparatus according to Claim 8, wherein said step (a) comprises the steps of:

(a1) forming a first concave portion passing through said first insulating layer to said under layer in said first insulating layer;

(a2) forming a first barrier metal film on said first insulating layer and a side wall and a bottom surface of said first concave portion; and

(a3) forming a first metal film on said first barrier metal film such that the rest of said first concave portion is filled with said first metal film.

10 (withdrawn). The manufacturing method of the semiconductor apparatus according to Claim 9, wherein said step (b) comprises the step of:

(b1) forming said additional metal film on said first metal film;

said step (d) comprises the step of:

(d1) removing said first barrier metal film, said first metal film and said additional metal film, which are processed said heat-treatment, on said first insulating layer and said first conductive portion.

11 (withdrawn). The manufacturing method of the semiconductor apparatus according to Claim 9, wherein a containing percentage of aluminium in said alloy is 0.1 to 10 atm%.

12 (withdrawn). The manufacturing method of the semiconductor apparatus according to Claim 11, wherein said heat-treatment is carried out in a temperature range of 200 °C to 270 °C in said step (c).

13 (withdrawn). The manufacturing method of the semiconductor apparatus according to Claim 12, wherein a resistance of said alloy is lower than that of said alloy when said alloy consists of

14 (withdrawn). The manufacturing method of the semiconductor apparatus according to Claim 13, wherein an aspect ratio of said first concave portion is equal to or greater than 2.

15 (withdrawn). The manufacturing method of the semiconductor apparatus according to Claim 14, wherein a width of said first conductive portion is equal to or less than 0.18 μm ,

a depth of said first conductive portion is equal to or greater than 0.3 μm ,

a thickness of said first barrier metal film is equal to or greater than 0.01 μm , such that said first metal film is formed in said first concave portion.

16 (withdrawn). The manufacturing method of the semiconductor apparatus according to Claim 8, wherein said step (a) comprises the steps of:

(a4) forming a first concave portion passing through said first insulating layer to said under layer in said first insulating layer;

(a5) forming a first barrier metal film on said first insulating layer and a side wall and a bottom surface of said first concave portion;

(a6) forming a first metal film on said first barrier metal film such that the rest of said first concave portion is fill with said first metal film; and

(a7) removing said first metal film on said first barrier metal film and said a conductive portion;

wherein said conductive portion comprises said first barrier metal film and said first metal film.

17 (withdrawn). The manufacturing method of the semiconductor apparatus according to Claim 16, wherein said step (b) comprises the step of:

(b2) forming said additional metal film on said first barrier metal film and said first conductive portion;

said step (d) comprises the step of:

(d2) removing said barrier metal film and said additional metal film, which are processed said heat-treatment, on said first insulating layer and said first conductive portion.

18 (withdrawn). The manufacturing method of the semiconductor apparatus according to Claim 16, wherein a containing percentage of alumimium in said alloy is 0.1 to 10 atm%.

19 (withdrawn). The manufacturing method of the semiconductor apparatus according to Claim 18, wherein said heat-treatment is carried out in a temperature range of 200 °C to 270 °C in said step (c).

20 (withdrawn). The manufacturing method of the semiconductor apparatus according to Claim 19, wherein a resistance of said alloy is lower than that of said alloy when said alloy consists of alumimium.

21 (withdrawn). The manufacturing method of the semiconductor apparatus according to Claim 20, wherein an aspect ratio of said first concave portion is equal to or greater than 2.

22 (withdrawn). The manufacturing method of the semiconductor apparatus according to Claim 21, wherein a width of said first conductive portion is equal to or less than 0.18 μm ,

a depth of said first conductive portion is equal to or greater than 0.3 μm ,

a thickness of said first barrier metal film is equal to or greater than 0.01 μm , such that said first metal film is formed in said first concave portion.

23 (new). The semiconductor apparatus according to Claim 1, wherein a containing percentage of aluminum in said first alloy is 5 to 10 atm%.

24 (new). The semiconductor apparatus according to Claim 1, wherein said barrier metal layer comprises at least one of Ti, TiN, Ta, TaN and WN.